AMENDMENTS TO THE CLAIMS

Please replace all prior versions and listings of claims with the following listing of claims.

1. **(Currently Amended)** A method for determining at least one process parameter in a device manufacturing process, the method comprising:

obtaining calibration spectral measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

determining a mathematical model by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients;

obtaining spectral measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter;

comparing the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model; and

adjusting a control parameter of a lithographic apparatus ~~using~~ based on the unknown value of said at least one process parameter for said object in the device manufacturing process.

2. **(Previously Presented)** The method according to claim 1, wherein said calibration measurement data and said measurement data are obtained with an optical detector.

3. **(Previously Presented)** The method according to claim 2, wherein said optical detector is a scatterometer.

4. **(Previously Presented)** The method according to claim 1, wherein the multi-variant regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

5. **(Previously Presented)** The method according to claim 1, wherein said object is a substrate.

6. **(Previously Presented)** The method according to claim 5, wherein the substrate comprises one of a group consisting of a test wafer and a product wafer.

7. **(Previously Presented)** The method according to claim 5, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

8. **(Previously Presented)** The method according to claim 7, wherein the at least one marker structure is a part of a device pattern within a chip area.

9. **(Previously Presented)** The method according to claim 1, wherein the at least one marker structure comprises a diffraction grating.

10. **(Previously Presented)** The method according to claim 1, wherein the method further comprises preprocessing the obtained calibration spectral measurement data and the obtained spectral measurement data before said employing said regression coefficients.

11. **(Previously Presented)** The method according to claim 10, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

12. **(Previously Presented)** The method according to claim 1 wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

13. **(Previously Presented)** The method according to claim 12, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

14. **(Previously Presented)** The method according to claim 12, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure comprises a pattern with dense lines or isolated spaces.

15. **(Previously Presented)** The method according to claim 12, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

16. **(Previously Presented)** The method according to claim 1, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

17. **(Cancelled)**

18. **(Previously Presented)** The method according to claim 1, wherein said method is related to at least one of a lithographic apparatus and a track.

19. **(Previously Presented)** The method according to claim 18, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

20. **(Previously Presented)** The method according to claim 18, wherein the lithographic apparatus comprises:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

21. **(Cancelled).**

22. **(Previously Presented)** A system for determining at least one process parameter, the system comprising:

a detector arranged to obtain calibration spectral measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

a processor unit storing a mathematical model determined by using said known values of said at least one process parameter and by employing a multi-variant regression technique on said calibration spectral measurement data, said mathematical model comprising a number of regression coefficients;

said processor unit being arranged to obtain spectral measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter; and to compare the obtained spectral measurement data with the calibration spectral measurement data to determine the unknown value of said at least one process parameter for said object from said obtained spectral measurement data by employing said regression coefficients of said mathematical model.

23. **(Previously Presented)** The system according to claim 22, wherein said detector is an optical detector.

24. **(Previously Presented)** The system according to claim 23, wherein said optical detector is a scatterometer.

25. **(Previously Presented)** The system according to any of the claim 22, wherein the multi-variant regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

26. **(Previously Presented)** The system according to any of the claim 22, wherein said object is a substrate.

27. **(Previously Presented)** The system according to claim 26, wherein the substrate comprises one of a group consisting of a test wafer and a product wafer.

28. **(Previously Presented)** The system according to claim 26, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

29. **(Previously Presented)** The system according to claim 28, wherein the at least one marker structure is a part of a device pattern within a chip area.

30. **(Previously Presented)** The system according to claim 22, wherein the at least one marker structure comprises a diffraction grating.

31. **(Previously Presented)** The system according to claim 22, wherein the processor unit is arranged to preprocess the obtained measurement data before said employing said regression coefficients.

32. **(Previously Presented)** The system according to claim 31, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

33. **(Previously Presented)** The system according to claim 22 wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

34. **(Previously Presented)** The system according to claim 33, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

35. **(Previously Presented)**The system according to claim 33, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure comprises a pattern with dense lines or isolated spaces.

36. **(Previously Presented)** The system according to claim 33, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

37. **(Previously Presented)** The system according to claim 22, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

38. **(Cancelled)**

39. **(Previously Presented)** The system according to claim 22, wherein said system comprises at least one of a lithographic apparatus and a track.

40. **(Previously Presented)** The system according to claim 39, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

41. **(Previously Presented)** The system according to claim 39, comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

42. **(Cancelled)**